

**MEDIUM EXPLORERS (MIDEX) 2016
ANNOUNCEMENT OF OPPORTUNITY (AO)
ELV LAUNCH SERVICES PROGRAM INFORMATION SUMMARY
10/14/2016**

NASA-Provided ELV Launch Services Ground Rules/Policy

This document provides additional information for NASA-provided ELV launch services. Any Expendable Launch Vehicles (ELV) provided by NASA will be procured and managed by the NASA/Launch Services Program (LSP) using government contracts. Under this AO, the Proposer may not arrange alternative access to space.

Under the provisions of the NASA Launch Services II (NLS II) contract, the launch service includes the Launch Vehicle (LV) and associated standard services, non-standard services (mission unique options), all engineering and analysis, and minimum performance standards. LSP also provides technical management of the launch service, technical insight into the LV production/test, coordinates and approves mission-specific integration activities, provides mission unique LV hardware/software development, provides payload-processing accommodations, and manages the launch campaign/countdown.

At the appropriate time following mission selection, LSP will competitively select a launch service provider and award a launch service for the mission based on customer requirements. The launch service is awarded to the Contractor that provides the best value in launch services to meet the Government's requirements based on technical capability/risk, reasonableness of proposed price, and past performance. Accordingly, assumption of a specific launch vehicle configuration as part of the AO proposal will not guarantee that the proposed LV configuration will be selected unless there is firm technical rationale for sole source. Any such rationale should be clearly identified and explained in the proposal.

All NASA-procured launch services will be compliant with NASA Policy Directive (NPD) 8610.7, NASA Launch Services Risk Mitigation Policy. Expendable launch services acquired by NASA will be managed in accordance with NPD 8610.23, Technical Oversight of Expendable Launch Vehicle (ELV) Launch Services and NPD 8610.24, Launch Services Program (LSP) Pre-Launch Readiness Reviews. These NPD's can be accessed through the following links:

[NPD 8610.7D](#)

[NPD 8610.23C](#)

[NPD 8610.24C](#)

Launch Vehicle Information/Configuration/Performance

For a NASA-provided ELV launch service, the proposal must be designed to the enveloping launch vehicle characteristics and capabilities provided in Attachment 1.

The LSP has developed a performance website for vehicles currently on contract to NASA. This website contains information relevant to NASA-procured launch services. This planning tool can be found at the following web address: <http://elvperf.ksc.nasa.gov/>. Access to this site is available to

anyone with an internet connection and is generally available at any time. There are currently some updates to vehicle configurations and performance that are being processed based on recent NLS II contract changes. For questions or data clarifications, utilize the point(s) of contact listed in this document.

Launch Service Costs

The Astrophysics Division within the Science Mission Directorate will hold the launch service costs. Standard services provided in the launch service costs to be covered by the Astrophysics Division are:

- the launch vehicle, engineering, analysis, and minimum performance standards and services provided by the NLS II contract in place at the time of LV selection;
- mission integration;
- launch site payload processing;
- range safety support;
- down range telemetry support (launch vehicle only);
- standard mission unique launch vehicle modifications/services –items typically necessary to customize the basic vehicle hardware to meet spacecraft driven requirements. Already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environments.

The Explorer LV budget set aside for MIDEX 2016 does not include funding for payload-caused launch delays.

Although use of low-level radioactive sources (i.e., with an A2 mission multiple less than 10, as defined in NPR 8715.3, Chapter 6 and Appendix D) is a non-standard service, there is no charge to the PI-Managed Mission Cost, as any charges are minimal (such a radiological storage during payload processing). Note that costs associated with environmental review and launch approval are separate from these activities (reference AO section 5.2.4).

Evaluation Criteria

Attachment 3 shows a preliminary Evaluation checklist to be used as a guide for the evaluators during the proposal evaluation phase. This checklist should give offerors an indication of the types of information that are expected to be contained in the proposals. If the proposal does not provide sufficient information to be evaluated for each section, the launch vehicle section of the proposal may not be evaluated for full content and may be listed as a finding.

NASA Launch Services Program Point of Contact (POC) for Additional Information

Additional information including performance quotes for other orbits/destinations, mission integration inquiries, standard services, and non-standard services costs may be obtained from the point of contact below. Otherwise questions must be directed as indicated in the Technical and Scientific Inquiries section of the AO.

Jim Hall, Mission Manager, NASA Launch Services Program
Code VA-C, Kennedy Space Center, FL 32899
Phone: 321.867.6218
Email: james.l.hall@nasa.gov

Attachment 1 ELV Launch Services Characteristics/Capabilities

Performance Information /Capabilities:

Table 1 lists some reference orbits/destinations, with expanded curves provided in Figures 1, 2 and 3. The performance listed represents the equivalent maximum mass allowed under the standard launch service for the purposes of this AO. Note that other inclinations/altitudes/orbit energies are also available.

Reference Orbit		Performance (kg)	Volume
LEO low inclination	600 km, 5 deg	1500	Large PLF (re: Fig. 4)
	600 km, 10 deg	1740	Large PLF
LEO due east	600 km, 28.5 deg	7215	Large PLF
LEO Sun Sync	700 km, SS	2865	Standard PLF (re: Fig. 3)
L2	C3 = -0.5	1500	Standard PLF
Lunar	C3 = -1.8	1550	Standard PLF

Table 1: Performance Capability at Reference Orbits

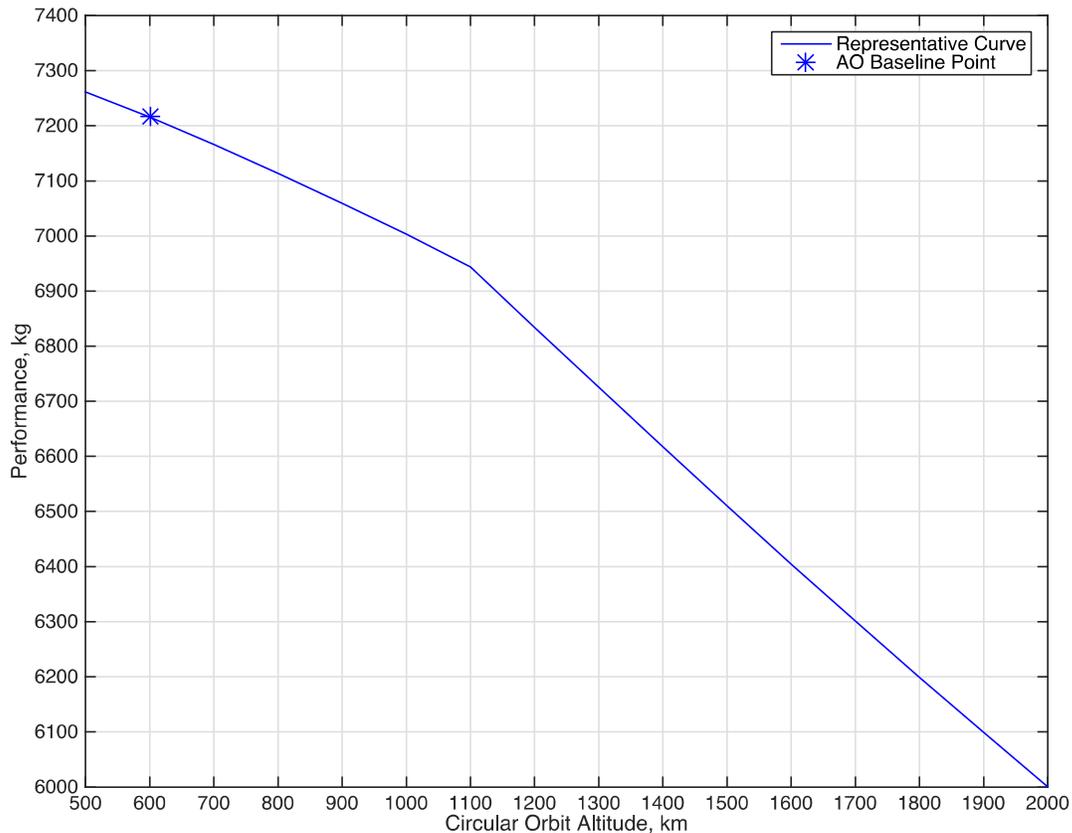


Figure 1: Representative Performance Capability at 28.5 deg Inclination

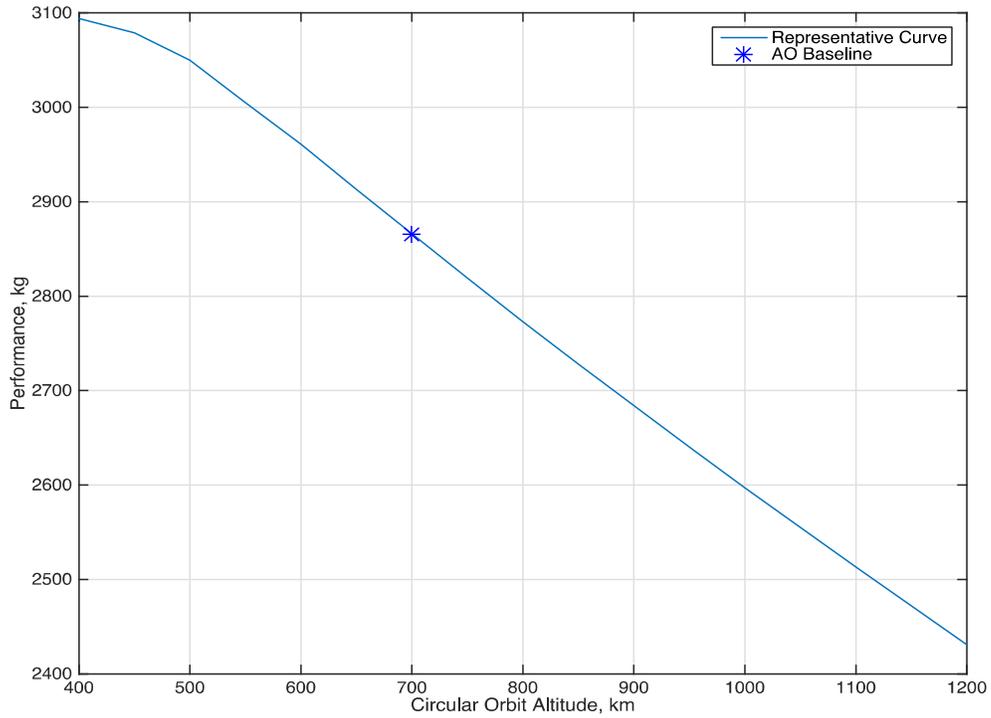


Figure 2: Representative Performance Capability at Sun-Synchronous Inclination

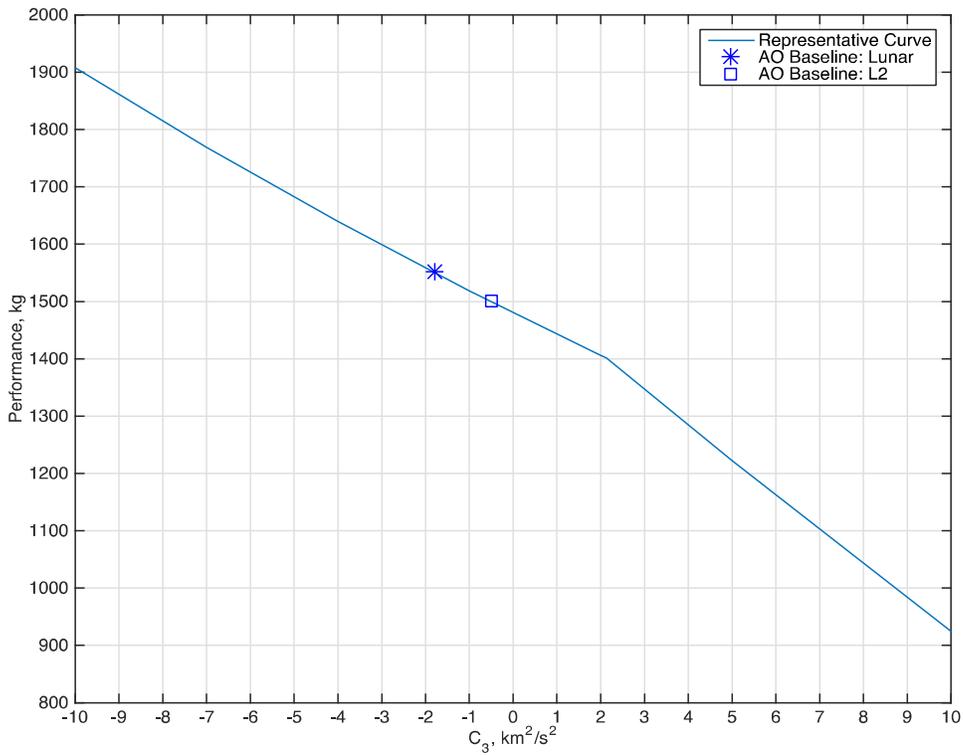


Figure 3: Representative Performance Capability to High Energy Orbits

Performance Ground Rules:

- The LV performance available on NLS-II generally does not include impacts associated with orbital debris compliance; this must be evaluated on a mission-specific basis. Depending on LV design, this could result in a significant performance impact to ensure full compliance with orbital debris policy.
- Guidance reserves have been allocated to account for 3-sigma flight performance.
- Performance is for a baseline LV configuration; non-standard, mission-unique hardware will require additional assessment.
- The standard and large PLFs use a 47-inch (1194 mm) separation system.
- Mass of entire separation system is book-kept on the launch vehicle side.

Payload Envelopes:

Depending on the orbit required, different payload fairing volumes are allowed under the standard launch service for the purposes of this AO.

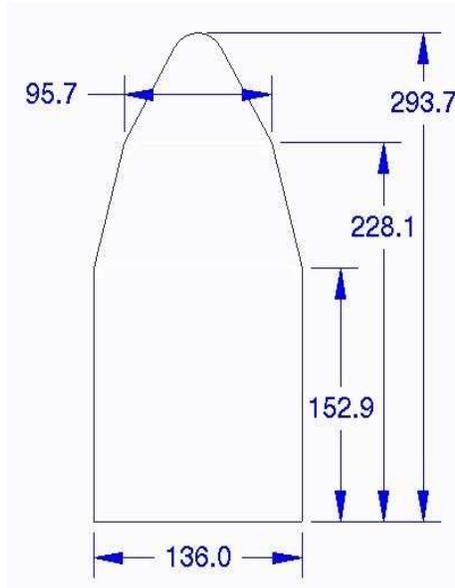
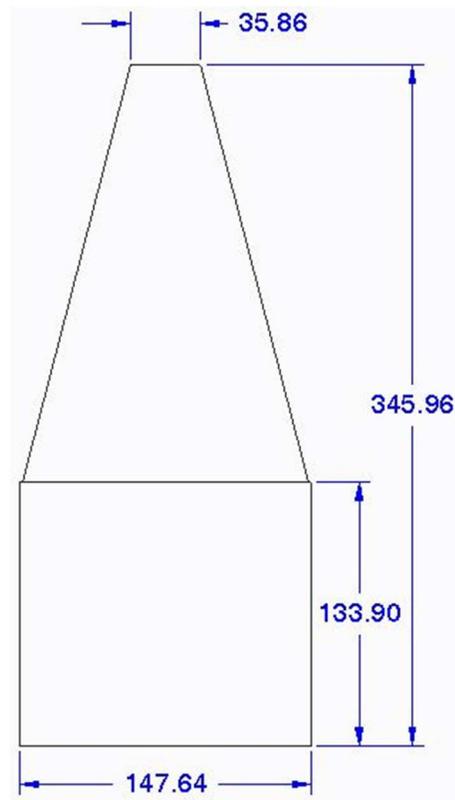


Figure 3: Standard PLF Static Envelope (inches)



**Figure 4: Large PLF Static Envelope (inches)
(Dimensions shown assume co-manifest of a 24 inch ESPA ring)**

Launch Vehicle Enveloping Environments:

In the Environments data below, a mass of 1360 kg was used.

Equivalent Sine Environment:

Envelope			
Frequency (Hz)	Axial	Frequency (Hz)	Lateral
5	0.75	5	0.5
12	0.8	42	0.5
30	0.8	42	0.9
35	0.75	54	0.9
35	1.5	54	0.5
100	1.5	80	0.5
		80	0.55
		85	0.55
		85	0.6
		100	0.6

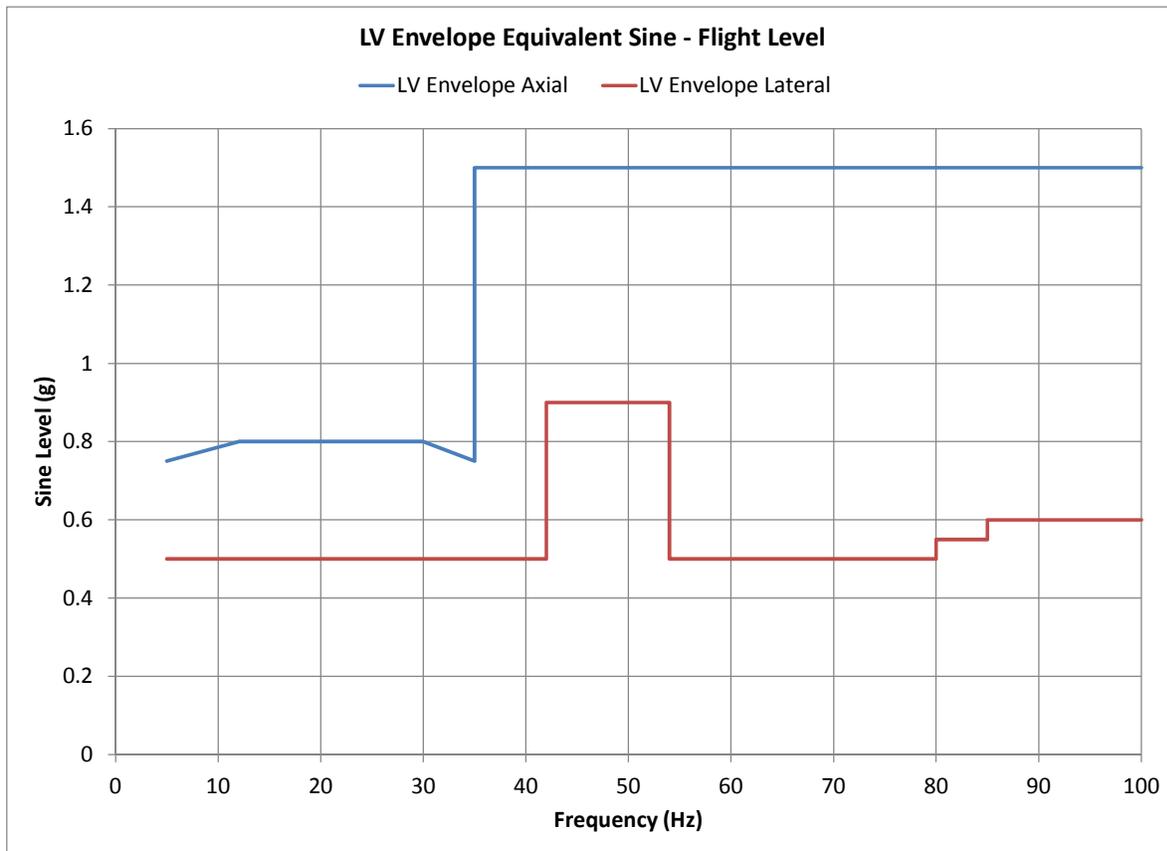


Figure 5: Enveloping Equivalent Sine – Flight Level

CG Loads Factors:

Envelope	
Lateral (g's)	Axial (g's)
0.5	7
0.5	6.5
1.5	6.5
2	3.5
2	-1.5
0.6	-2
-0.6	-2
-2	-1.5
-2	3.5
-1.5	6.5
-0.5	6.5
-0.5	7
0.5	7

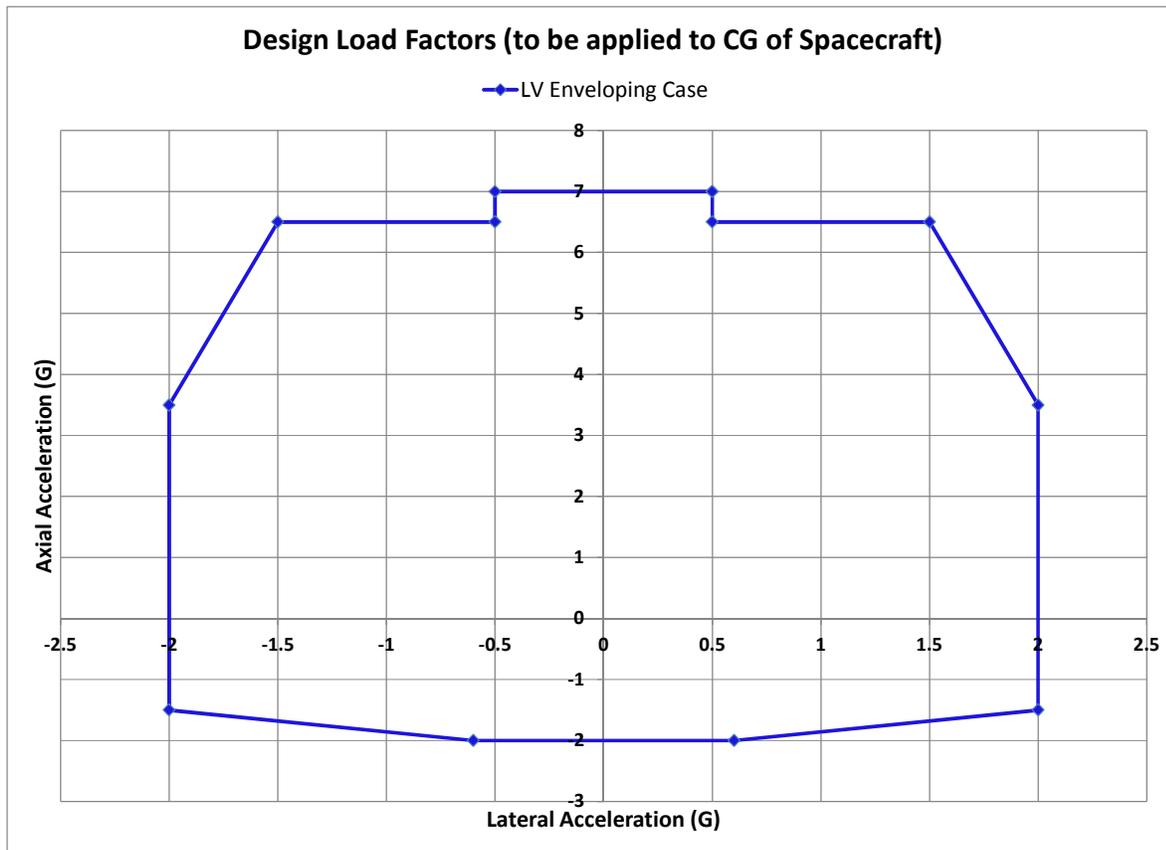


Figure 6: Enveloping Design Load Factors (to be applied to CG of Spacecraft)

Note: If payload weight is less than 1360 kg, an early CLA is recommended to obtain the correct CG load factors as the above shown values might not be conservative.

Acoustic Environment:

Envelope	
Frequency (Hz)	SPL (dB)
20	123.8
25	124.4
31.5	125.5
40	128.5
50	128.5
63	129.7
80	130.7
100	131.4
125	131.7
160	131.6
200	131.3
250	129.2
315	130.6
400	128.9
500	127.6
630	128.4
800	128.6
1000	126.9
1250	123.1
1600	117.5
2000	117.3
2500	116.3
3150	114.1
4000	116.7
5000	111.8
6300	111
8000	110
10000	109.1

Overall SPL (dB) = 142

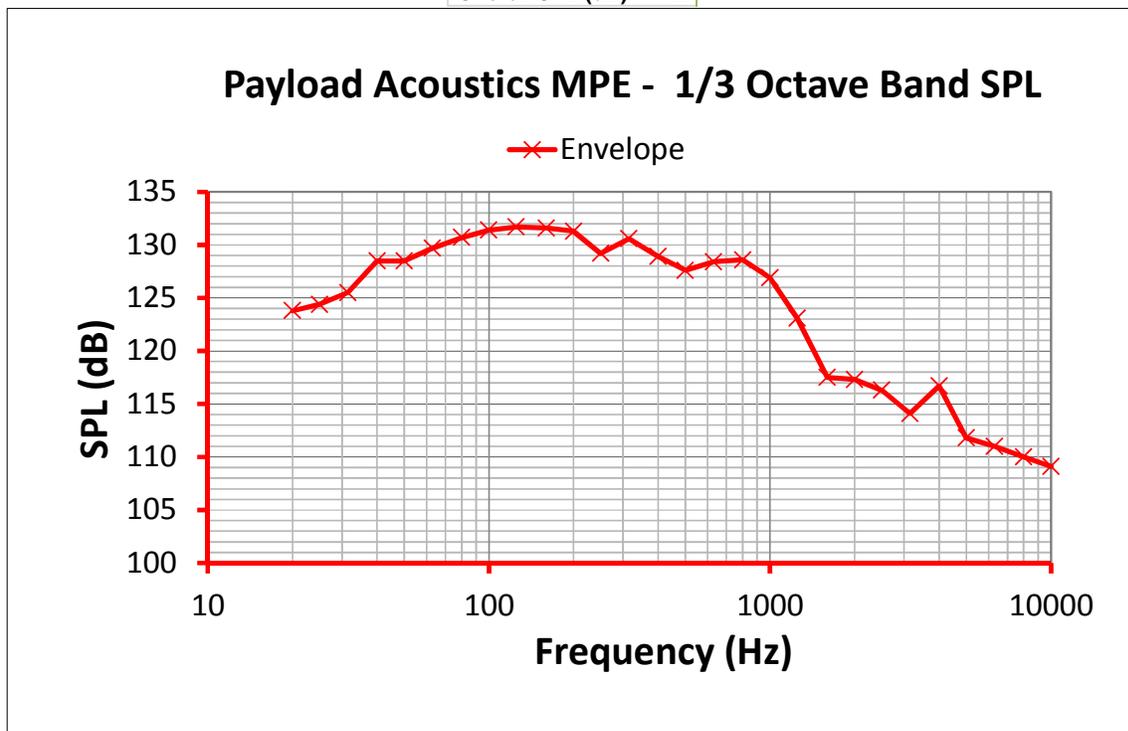


Figure 7: Enveloping Payload Acoustics MPE – 1/3 Octave Band SPL

Shock Environment:

Hz	SRS (g-peak)
100	100
625	2000
10000	2000

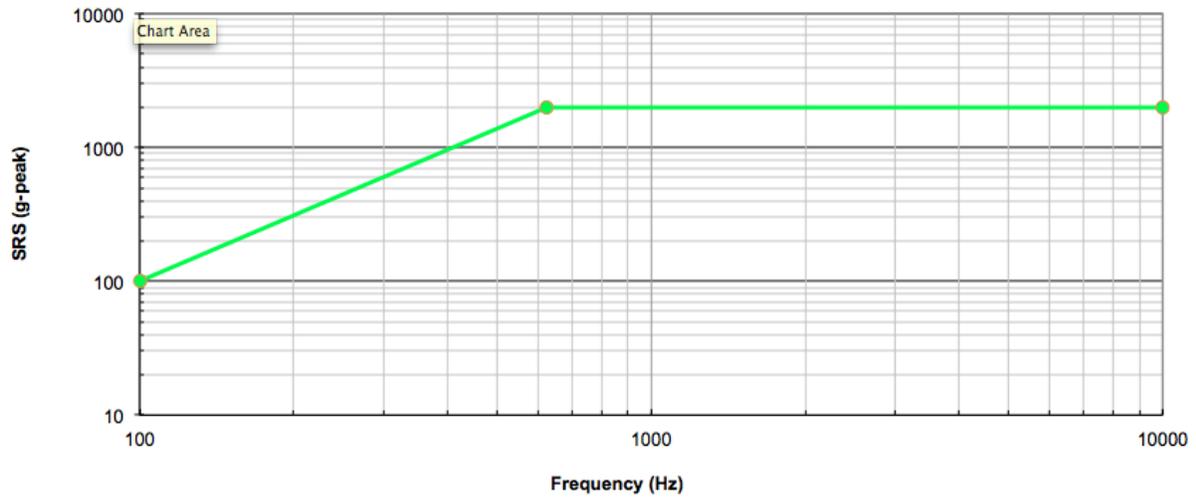


Figure 8: Enveloping P95/50 Shock Environment at Separation Plane (LV side)

Note: The provided shock curve is based on LSP experience with separation shock test data of past missions

Attachment 2

NASA-LSP Standard Launch Services

This list provides an overview of the standard services that the spacecraft customer receives with NASA-LSP as their launch service provider.

Integrated Services:

- Range support and services
- Payload processing facility and support
- Contractor Engineering support
- Base Support contractors
- Logistics
- Hazardous support

Launch Vehicle:

- Launch vehicle that meets customer's performance needs
- Payload Fairing with approximately 2 access doors with thermal and/or acoustic blankets
- Standard LV-provided Payload Separation System
- Standard Payload Adapter
- Standard Test Payload adapter availability
- Spacecraft Spin/De-spin capability for separation (if required)
- Single-Spacecraft Collision/Contamination Avoidance Maneuver (CCAM) capability if needed
- Electrical interface connectors (approximately 3 sets)
- Mission Unique Reviews (approximately 3)
- Readiness Reviews (approximately 4)
- Risk Management
- Launch Vehicle insight and approval
- Mission integration management & engineering support
- Launch campaign management
- Down range telemetry assets for LV data

Nominal Mission Unique Services

- Mission Unique payload isolation system
- T-0 GN2 or pure air Purge
- Class 10K integration environment

The following list provides a few examples of non-standard/mission unique services that are not included in this AO's NASA-provided launch service, and whose cost would need to be included as part of the Principle Investigator-Managed Mission Cost. Contact the LSP POC for further information on these and other non-standard/mission unique services.

- Custom payload adapters
- Deployable telemetry tracking assets for multiple spacecraft missions
- LV mods/analyses for non-separating interface with multiple SC deployments

Attachment 3
Evaluation Form
Launch Services Program

Proposal Name: _____

Proposal #: _____

Evaluator POC: _____

Phone: _____

Email: _____

Launch Service Technical Evaluation:

Overall Assessment: - Given the ground rules in the AO, is the proposed launch vehicle (LV) concept feasible for this application? (Yes or No)

Comments: _____

LV Performance: Area of concern (Yes or No)

Proposed LV configuration: _____

Proposed Launch Date: / / _____

Launch Period (MM/DD/YYYY to MM/DD/YYYY): / / to / / _____

Launch Window (On any given day of the launch period Minutes:Seconds): :

Orbit requirements: Apogee: _____ km Perigee: _____ km Inclination: _____ deg.

High Energy requirements: C3: _____ km²/sec² DLA: _____ deg RLA: _____ deg

Proposed LV Performance: _____

Mass: (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

Dry Mass Margin: _____ kg _____ %

Wet Mass Margin: _____ kg _____ %

Formulas:

Mass Margin kg = LV Performance – S/C Mass (including reserves)

Mass Margin % = [(Mass Margin kg)/ S/C Mass (including reserves) kg] X 100

LV Performance Comments/Issues/Concerns: _____

Launch Service Cost Assessment: Area of concern (Yes or No)

Is there additional funding for any mission unique modifications/services? (Yes or No)

LV Integration: Area of concern (Yes or No)

Does the proposer have experience in LV integration? (Yes or No)

LV to Spacecraft Interface: Area of concern (Yes or No)

Proposed Payload Fairing (PLF) _____

Spacecraft (S/C) Dimensions: Radial: _____ m Height _____ m

Any intrusions outside of the PLF usable dynamic volume? (Yes or No)

Mechanical Interface:

Standard Adapter: _____

Custom Adaptor: _____

Electrical Interface:

Standard _____ Pin(s) Connector(s): (Yes or No)

Mission Unique requirements:

Instrument T-0 GN₂ Purge: (Yes or No)

T-0 S/C Battery Cooling: (Yes or No)

Planetary Protection Requirements: (Yes or No)

Contamination Control Requirements: PLF: (Yes or No)

LV adapter: (Yes or No)

Cleanliness Level: _____ other: _____

Unique Facility Requirements: (Yes or No)

Pad: _____

S/C Processing Facility: _____

S/C Environmental Test Plans:

Environmental Test Plan/Flow described: (Yes or No)

Test Levels provided: (Yes or No)

Test Schedule provided: (Yes or No)

Comments/Issues/Concerns:

Spacecraft Schedule: Area of concern (Yes or No)

Adequate timing of: Launch Service Integration Start Time: Yes or No
S/C Environmental Test Program: (Yes or No)
Delivery of Verified S/C Model: (Yes or No)
S/C ship date: (Yes or No)
S/C to LV integrated Operations: (Yes or No)

Missions with Radiological material Area of concern (Yes or No)

List the Radiological Sources: _____

Are unique facilities required to store/process the Radiological Sources? (Yes or No)

Any LV modifications required for additional safety or Launch approval? (Yes or No)